WHAT IS CLAIMED IS:

1. A rotating drum pressure differential filter comprising:

a drum rotatable about an axis of rotation, said drum including at least one wall having an inner surface that at least partially defines an inner chamber, and an outer surface, said wall including at least one opening for allowing the passage of fluid from outside the drum to said inner chamber;

a drive to rotate said drum about said axis of rotation;

a source of differential pressure to provide a lower pressure in said inner chamber than outside said drum;

a container for containing a sample medium having components to be separated, said container being positioned with respect to said drum such that, in operation, said drum is rotated about said axis of rotation and at least a portion of a layer of filter medium applied to the outside surface of said drum rotates within the container to contact a sample medium disposed within the container;

a scraper adapted to be positioned adjacent said drum for scraping a layer of filter medium from said drum; and

an applicator adapted to be positioned adjacent said drum between said scraper and said container for directing a layer of filter medium toward said outer surface.

2. The filter of claim 1, wherein, relative to the direction of rotation of said drum, said applicator is located downstream of said scraper and said container is located downstream of said applicator.

3. The filter of claim 1, wherein a filter medium is applied to the outer surface of said drum as a layer which can be scraped off of said outer surface, said filter medium being capable of covering said at least one opening and being adapted to separate components that

can pass through said layer and through said at least one opening from components that cannot pass through said layer.

4. The filter of claim 1, wherein said applicator comprises at least one nozzle.

5. The filter of claim 4, wherein said applicator comprises a pressurized gas conduit, a pressurized filter medium conduit, and a nozzle that combines pressurized gas from said pressurized gas conduit with pressurized filter medium from said pressurized filter medium conduit, to form a spray.

6. The filter of claim 5, wherein said pressurized filter medium conduit is disposed within said pressurized gas conduit.

7. The filter of claim 6, wherein said nozzle includes an orifice plate having a backside which in operation contacts filter medium flowing through said pressurized filter medium conduit, a front side opposite said backside, and an opening through said orifice plate to allow for the passage of filter medium from said pressurized filter medium conduit through said nozzle.

8. The filter of claim 7, wherein in operation filter medium flows through said pressurized filter medium conduit in a direction substantially tangential to the backside of said orifice plate.

9. The filter of claim 3, wherein filter medium is circulated through said pressurized filter medium conduit.

10. The filter of claim 1, wherein said container contains a sample medium and said sample medium comprises at least one enzyme and at least one other component to be separated from said at least one enzyme.

11. The filter of claim 1, wherein said container contains a sample medium and said sample medium comprises a fermentation broth.

12. The filter of claim 3, wherein said filter medium comprises diatomaceous earth.

13. The filter of claim 1, wherein, in operation, said applicator is positioned with respect to said drum such that said applicator directs a fresh layer of filter medium toward said outer surface prior to said fresh layer of filter medium rotating within said container and contacting a sample medium, and said scraper is positioned with respect to said drum such that said scraper scrapes a first layer of filter medium from said drum after the first layer rotates within said container and contacts a sample medium and before said applicator directs a subsequent layer of filter medium toward said drum.

14. The filter of claim 1, wherein said scraper moves toward said drum as said drum rotates about said axis of rotation such that the layer of filter medium remaining on the drum as the drum rotates and the scraper scrapes becomes thinner and thinner.

15. The filter of claim 1, wherein said applicator and said scraper are fixed with respect to each other and said scraper is fixed in relation to said drum such that said scraper maintains said applicator at a fixed distance away from an outer surface of the layer of filter medium.

16. A system comprising the filter of claim 1 and a second rotating drum pressure differential filter, wherein said second filter comprises filter medium scraped from the filter of claim 1 as a sample medium, a filter medium, or both.

17. A rotating drum pressure differential filter comprising:

a drum rotatable about an axis of rotation, said drum including at least one wall having an inner surface that at least partially defines an inner chamber, and an outer surface, said wall including at least one opening for allowing the passage of fluid from outside the drum to said inner chamber;

a drive to rotate said drum about said axis of rotation;

a source of differential pressure to provide a lower pressure in said inner chamber than outside said drum;

a container for containing a sample medium having components to be separated, said container being positioned with respect to said drum such that, in operation, said drum is rotated about said axis of rotation and at least a portion of a layer of filter medium applied to the outside surface of said drum rotates within the container to contact a sample medium disposed within the container;

a scraper adapted to be positioned adjacent said drum for scraping a layer of filter medium from said drum;

an applicator adapted to be positioned adjacent said drum between said scraper and said container for directing a layer of filter medium toward said outer surface; and

means to simultaneously operate said scraper and said applicator such that, in operation, said applicator directs a layer of filter medium toward said outer surface at the same time that said scraper scrapes a layer of filter medium from said drum.

18. The filter of claim 17, further comprising a filter medium applied to the outer surface of said drum as a layer which can be scraped off of said outer surface, said filter medium being capable of covering said at least one opening and separating components that can pass through said layer and through said at least one opening from components that cannot pass through said layer.

19. The filter of claim 17, wherein said applicator and said scraper are fixed with respect to each other by a mounting means that maintains said applicator at a constant distance away from an outer surface of a layer of filter medium scraped by said scraper.

20. A rotating pressure differential filter comprising:

a housing rotatable about an axis of rotation, said housing including at least one wall having an inner surface and an outer surface, said inner surface at least partially defining an inner chamber, said wall including at least one opening for allowing the passage of fluid from outside the housing to said inner chamber;

drive means for rotating said housing about said axis of rotation;

differential pressure means for providing a lower pressure in said inner chamber than outside said housing;

a container for containing a sample medium having components to be separated, said container being positioned with respect to said housing such that, in operation, said housing is rotated about its axis of rotation and at least a portion of a layer of filter medium applied to the outside surface of said housing rotates within the container to contact a sample medium disposed within the container;

scraping means adapted to be positioned adjacent said outer surface for scraping a layer of filter medium from said outer surface;

applicator means adapted to be positioned adjacent said outer surface between said scraper and said container for directing a fresh layer of filter medium toward said outer surface;

wherein, in operation:

said applicator means is positioned with respect to said housing such that said applicator means directs a fresh layer of filter medium toward said outer surface prior to said fresh layer of filter medium rotating within said container and contacting a sample medium; and

said scraping means is positioned with respect to said housing such that in operation said scraping means scrapes a first layer of filter medium from said outer surface after the first layer rotates within said container and contacts a sample medium and before said applicator means directs a subsequent layer of filter medium toward said outer surface.

21. The filter of claim 20, further comprising a filter medium applied to the outer surface of said drum as a layer and which can be scraped off of said outer surface, said filter medium being capable of covering said at least one opening and separating components that can pass

through said layer and through said at least one opening from components that cannot pass through said layer.

22. A method of separating components from a sample containing components to be separated, said method comprising:

rotating a rotating drum pressure differential filter about an axis of rotation, said drum including at least one wall having an inner surface that at least partially defines an inner chamber, and an outer surface, said wall including at least one opening for allowing the passage of fluid from outside the drum to said inner chamber, said drum further including a layer of filter medium applied to the outer surface of said wall and covering said at least one opening, said layer of filter medium separating components that can pass through said layer and said at least one opening from components that cannot pass through said at least one opening;

causing a pressure differential such that the pressure inside said inner chamber is less than the pressure outside the drum;

contacting the layer of filter medium with a sample medium having components to be separated as said drum rotates such that the pressure differential forces components that can pass through said layer and through said at least one opening to be separated from components that cannot pass through said layer;

scraping at least a portion of said layer of filter medium from said drum after said portion contacts said sample medium; and

applying filter medium to said outer surface after said scraping to form a fresh layer of filter medium that is then subsequently contacted with said sample medium.

23. The method of claim 22, wherein said scraping and said applying are performed simultaneously.

24. The method of claim 22, wherein said applying comprises spraying a composition of said filter medium onto the outer surface of said rotating drum or onto an existing layer of filter medium on the outer surface of said rotating drum.

25. The method of claim 22, wherein said applying comprises spraying said filter medium from a nozzle that combines pressurized gas from a pressurized gas conduit with pressurized filter medium from a pressurized filter medium conduit to form a spray.

26. The method of claim 25, wherein said pressurized filter medium conduit is disposed within said pressurized gas conduit.

27. The method of claim 25, wherein said nozzle includes an orifice plate having a backside in contact with filter medium flowing through said pressurized filter medium conduit, a front side opposite said backside, and an opening through said plate to allow for the passage of filter medium from said pressurized filter medium conduit through said nozzle.

28. The filter of claim 27, wherein filter medium flows through said pressurized filter medium conduit in a direction substantially tangential to the backside of said orifice plate.

29. The method of claim 22, wherein said sample medium comprises at least one enzyme and at least one other component to be separated from said at least one enzyme.

30. The method of claim 22, wherein said container contains a sample medium and said sample medium comprises a fermentation broth.

31. The method of claim 22, wherein said filter medium comprises diatomaceous earth.

32. The method of claim 22, wherein said scraper scrapes a layer of filter medium from said outer surface while leaving a layer of filter medium on said outer surface.

33. The method of claim 22, wherein said applicator and said scraper are fixed with respect to each other and said scraper is fixed in relation to said drum such that said scraper maintains said applicator at a fixed distance away from the layer of filter medium remaining after said scraper scrapes said layer of filter medium.

34. The method of claim 22, further comprising employing filter medium scraped from said filter as a sample medium, a filter medium, or both, for a second rotating drum pressure differential filter.

35. The method of claim 34, wherein filter medium is recirculated between said rotating drum pressure differential filter and one or more other rotating drum pressure differential filters.

36. A rotating drum pressure differential filter system comprising:

at least a first and a second rotating drum pressure differential filter, each of said first and second filters comprising:

a drum rotatable about an axis of rotation, said drum including at least one wall having an inner surface that at least partially defines an inner chamber, and an outer surface, said wall including at least one opening for allowing the passage of fluid from outside the drum to said inner chamber;

a drive to rotate said drum about said axis of rotation;

a source of differential pressure to provide a lower pressure in said inner chamber than outside said drum;

a container for containing a sample medium having components to be separated, said container being positioned with respect to said drum such that, in operation, said drum is rotated about said axis of rotation and at least a portion of a layer of filter medium applied to the outside surface of said drum rotates within the container to contact a sample medium disposed within the container;

at least one of said first and second rotating drum pressure differential filters having a scraper to remove sample medium, filter medium, or both, from the respective outer surface; and

a conveyor to convey scraped sample medium, scraped filter medium, or both, from one of said first and second rotating drum pressure differential filters for use in the other of said first and second rotating drum pressure differential filters.

37. The system of claim 36, wherein at least one of said first and second filters further comprises a filter medium, applied as a layer to the outer surface of the respective drum of the filter, and which can be scraped off of the outer surface of said respective drum, said filter medium being capable of covering said at least one opening and separating components that can pass through said layer and through the respective at least one opening from components that cannot pass through said layer.

38. The system of claim 37, wherein in operation:

said scraper is fixed with respect to its respective drum such that said scraper scrapes at least a portion of said layer of filter medium off of the outer surface of its respective drum after the layer rotates within said container and contacts a sample medium.

39. The system of claim 36, wherein at least one of said first and second rotating drum pressure differential filters further comprises an applicator for directing a layer of said filter medium toward its respective outer surface.

40. The system of claim 39, wherein, in operation:

said applicator means is fixed with respect to its respective drum such that said applicator means applies a layer of filter medium to said outer surface prior to said layer of filter medium rotating within said container and contacting a sample medium.

41. The system of claim 39, wherein said applicator comprises at least one nozzle.

42. The system of claim 36, wherein at least one of said containers of said first and second filters contains a sample medium and said sample medium comprises at least one enzyme and at least one other component to be separated from said at least one enzyme.

43. The system of claim 36, wherein at least one of said containers of said first and second filters contains a sample medium and said sample medium comprises a fermentation broth.

44. The system of claim 37, wherein said filter medium comprises diatomaceous earth.

45. The system of claim 36, wherein said scraper is positioned with respect to its respective rotating drum to scrape a layer of filter medium from the outer surface of said respective drum while leaving a layer of filter medium on the outer surface of said respective drum.

46. A method of separating components from a sample medium, said method comprising:

rotating a first rotating drum pressure differential filter about an axis of rotation, said first filter comprising a first rotating drum including at least one wall having an inner surface that at least partially defines an inner chamber, and an outer surface, said wall including at least one opening for allowing the passage of fluid from outside the drum to said inner chamber, said drum further including a layer of filter medium applied to the outer surface of said wall and covering said at least one opening, said layer of filter medium separating filtrate components that can pass through said layer and said at least one opening from components that cannot pass through said at least one opening;

causing a pressure differential such that the pressure inside said inner chamber is less than the pressure of the atmosphere outside the first rotating drum;

contacting the layer of filter medium with a sample medium having components to be separated as said drum rotates such that the pressure differential forces at least one filtrate component that can pass through said layer and through said at least one opening to be separated from components that cannot pass through said layer;

scraping sample medium, filter medium, or both, off of said outer surface after said layer contacts said sample medium;

conveying scraped sample medium, scraped filter medium, or both, from said first rotating drum pressure differential filter to a second rotating drum pressure differential filter;

operating said second rotating drum pressure differential filter to use said scraped sample medium, scraped filter medium, or both, as a second sample medium, a second filter medium, or as both a second sample medium and a second filter medium; and

separating said at least one filtrate component from other components of said scraped sample medium, scraped filter medium, or both.

47. The method of claim 46, further comprising applying filter medium to said outer surface where said sample medium, filter medium, or both, has been scraped off to form a reformed layer of filter medium that is then subsequently contacted with said sample medium.

48. The method of claim 47, wherein said applying comprises spraying a composition of said filter medium toward the outer surface of said first rotating drum.

49. The method of claim 47, wherein said applying comprises spraying said filter medium from a nozzle that combines pressurized gas from a pressurized gas conduit with pressurized filter medium from a pressurized filter medium conduit to form a spray.

50. The method of claim 46, wherein said sample medium comprises at least one enzyme and at least one other component to be separated from said at least one enzyme.

51. The method of claim 50, wherein said at least one filtrate component comprises said at least one enzyme.

52. The method of claim 46, wherein said sample medium comprises a fermentation broth.

53. The method of claim 46, wherein said filter medium comprises diatomaceous earth.

54. The method of claim 46, wherein said scraper scrapes a layer of filter medium from said outer surface while leaving a layer of filter medium on said outer surface.

55. The method of claim 46, wherein filter medium is scraped off of the outer surface of said first rotating drum and is recirculated between said first rotating drum pressure differential filter and at least said second rotating drum pressure differential filter.

56. A method of increasing the yield of a filtrate component comprising carrying out the method of separating components of claim 46, wherein the combined yield of: (1) said at least one filtrate component separated from said sample medium by said first rotating drum pressure differential filter; and (2) said at least one filtrate component separated from said second sample medium, said second filter medium, or both; is greater than the yield of said at least one filtrate component separated from said sample medium by said first rotating drum pressure differential filter alone.

57. The method of claim 56, wherein said at least one filtrate component comprises an enzyme.

58. The method of claim 56, wherein the throughput rate of processed sample medium is also increased relative to the throughput rate necessary to achieve the same yield of filtrate component with a single rotating drum pressure differential filter alone.

59. A method of reducing the down time of a rotating drum pressure differential filter used in a process of separating components from a sample medium, said method comprising:

rotating a first rotating drum pressure differential filter about an axis of rotation, said filter comprising a drum including at least one wall having an inner surface that at least partially defines an inner chamber, and an outer surface, said wall including at least one opening for allowing the passage of fluid from outside the drum to said inner chamber, said drum further including a layer of filter medium applied to the outer surface of said wall and covering said at least one opening, said layer of filter medium separating components that can pass through said layer and said at least one opening from components that cannot pass through said at least one opening;

causing a pressure differential such that the pressure inside said inner chamber is less than the pressure of the surrounding atmosphere outside the drum;

contacting the layer of filter medium with a sample medium having components to be separated as said drum rotates such that the pressure differential forces components that can pass through said layer and through said at least one opening to be separated from components that cannot pass through said layer;

scraping filter medium off of said outer surface after said layer contacts said sample medium; and

applying additional filter medium to said outer surface or filter medium remaining on said outer surface after said scraping to form a reformed layer of filter medium; wherein downtime is reduced by simultaneously applying and scraping.

60. The method of claim 59, wherein said reformed layer of filter medium is formed on a location on the drum, relative to a direction of rotation of said drum, between where the drum has been scraped and where the drum contacts the sample medium.

61. The method of claim 59, wherein said applying comprises spraying a composition of said filter medium toward the outer surface.

62. The method of claim 59, wherein said applying comprises spraying said filter medium from a nozzle that combines pressurized gas from a pressurized gas conduit with pressurized filter medium from a pressurized filter medium conduit to form a spray.

63. The method of claim 59, wherein said sample medium comprises at least one enzyme and at least one other component to be separated from said at least one enzyme.

64. The method of claim 59, wherein said sample medium comprises a fermentation broth.

65. The method of claim 59, wherein said filter medium comprises diatomaceous earth.

66. The method of claim 59, wherein said scraper scrapes a layer of filter medium from said outer surface while leaving a layer of filter medium on said outer surface.

67. The method of claim 59, wherein filter medium is scraped off of said first rotating drum outer surface and is recirculated between said first rotating drum pressure differential filter and at least one other rotating drum pressure differential filter.

68. A method of increasing throughput of an enzyme fermentation process, comprising:

separating at least one enzyme from a sample medium comprising said at least one enzyme, said separating comprising filtering said at least one enzyme from said sample medium through a first rotating drum pressure differential filter to form a filtered sample medium; and

conveying said filtered sample medium to at least a second rotating drum pressure differential filter to further separate said at least one enzyme from said filtered sample medium.

69. The method of claim 68, wherein said separating through said first rotating drum pressure differential filter comprises separating less than about 90% of said at least one enzyme from said sample medium.

70. The method of claim 68, wherein said separating through said first rotating drum pressure differential filter comprises separating less than about 80% of said at least one enzyme from said sample medium.

71. The method of claim 68, wherein said separating through said first rotating drum pressure differential filter comprises separating less than about 70% of said at least one enzyme from said sample medium.

72. An applicator device adapted to be positioned with respect to a rotary drum filter having a scraper to scrape sample medium, filter medium, or both, from an outer surface of the rotating drum filter, said device comprising an applicator for applying a layer of filter

medium to the outer surface or to an existing layer of filter medium disposed on said outer surface; and

a positioning structure to position said applicator relative to said scraper such that in operation of said drum said applicator is maintained at a constant distance from an outer surface of a layer of filter medium disposed on the outer surface of the drum.

73. The applicator device of claim 72, wherein said applicator comprises at least one nozzle.

74. The applicator device of claim 72, wherein said applicator comprises a pressurized gas conduit, a pressurized filter medium conduit, and a nozzle that combines pressurized gas from said pressurized gas conduit with pressurized filter medium from said pressurized filter medium conduit, to form a spray.

75. The applicator device of claim 74, wherein said pressurized filter medium conduit is disposed within said pressurized gas conduit.

76. The applicator device of claim 75, wherein said nozzle includes an orifice plate having a backside in contact with filter medium flowing through said pressurized filter medium conduit, a front side opposite said backside, and an opening through said orifice plate to enable the passage of filter medium from said pressurized filter medium conduit through said nozzle.